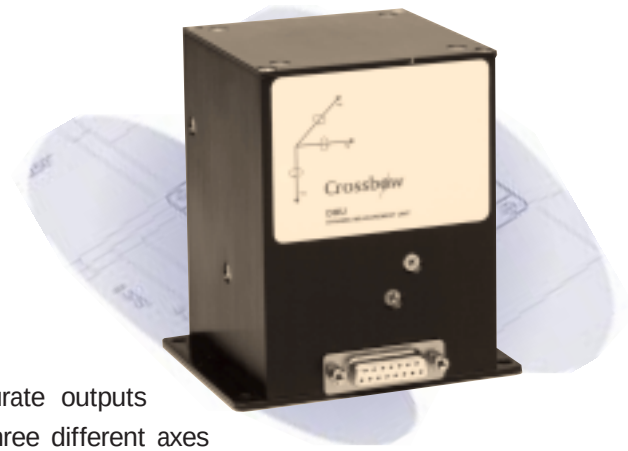
# DMU-AHRS:
## Attitude & Heading Reference System

- **X, Y, Z Acceleration**
- **Roll, Pitch, Yaw Angular Rate**
- **3-Axis Magnetic Sensors**
- **Dynamic Roll, Pitch & Heading Angle Output**




The DMU-AHRS is an intelligent directional gyro for roll, pitch and heading angle measurement in dynamic environments. The DMU-AHRS is also a nine axis measurement system that outputs accurate acceleration, angular rates and magnetic orientation. The DMU-AHRS uses the latest in solid state sensor technology resulting in superior performance, reliability, and stability over time and operating environments. The digital and analog outputs of of the nine sensors are formatted for easy system integration. Example applications include augmented GPS navigation, dynamic positioning, and automotive testing. The digital and analog outputs of dynamic pitch and roll are ideal for camera and platform stabilization.

The technology used in the DMU-AHRS is a combination of silicon MEMS accelerometers and Coriolis-effect angular rate sensors, state-of-the-art magnetometers, and high-performance, digital signal processing. The magnetometers generate extremely accurate outputs in three different axes of orientation. Complex algorithms are integrated within Crossbow's patented SoftSensor embedded firmware, which provide stabilized roll, pitch, and heading angle information to within one degree of accuracy.

Each DMU-AHRS shipment comes complete with a DMU User's Manual offering helpful hints on programming, installation, and product information. In addition, Crossbow's X-View software is included to assist you in your system development, evaluation efforts, and allows you to perform data acquisition.

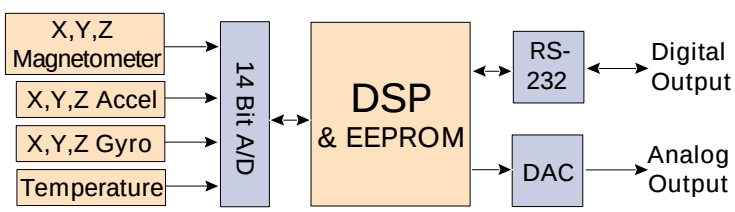



Figure 1

| DMU Products | Description | Output |
|---|---|---|
| DMU-6X | Direct digital voltage and signal conditioned analog outputs. Also outputs calibrated engineering units. | XYZ Acceleration<br>3 Axis Angular Rate |
| DMU-VGX | Tilt angle (roll/pitch) is computed. -6X outputs also included. | Roll & Pitch<br>XYZ Acceleration<br>3 Axis Angular Rate |
| DMU-AHRS | XYZ Acceleration,3 Axis Angular Rate, 3 Axis Magnetometer | Roll, Pitch, Heading<br>XYZ Acceleration<br>3 Axis Angular Rate |
| DMU-FOG | High accuracy tilt angle (roll/pitch) is computed. -6 outputs also included. | Roll & Pitch<br>XYZ Acceleration<br>3 Axis Angular Rate |

Table 1. Description of DMU Products

## ORDERING INFORMATION

| Part# | |
|---|---|
| BASE PART | |
| DMU-AHRS | Attitude & Heading Reference System |

Note: Please specify the desired rate (50, 100, 150°/Sec)

Crossbow

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# DMU-AHRS:
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## DMU-AHRS Specifications

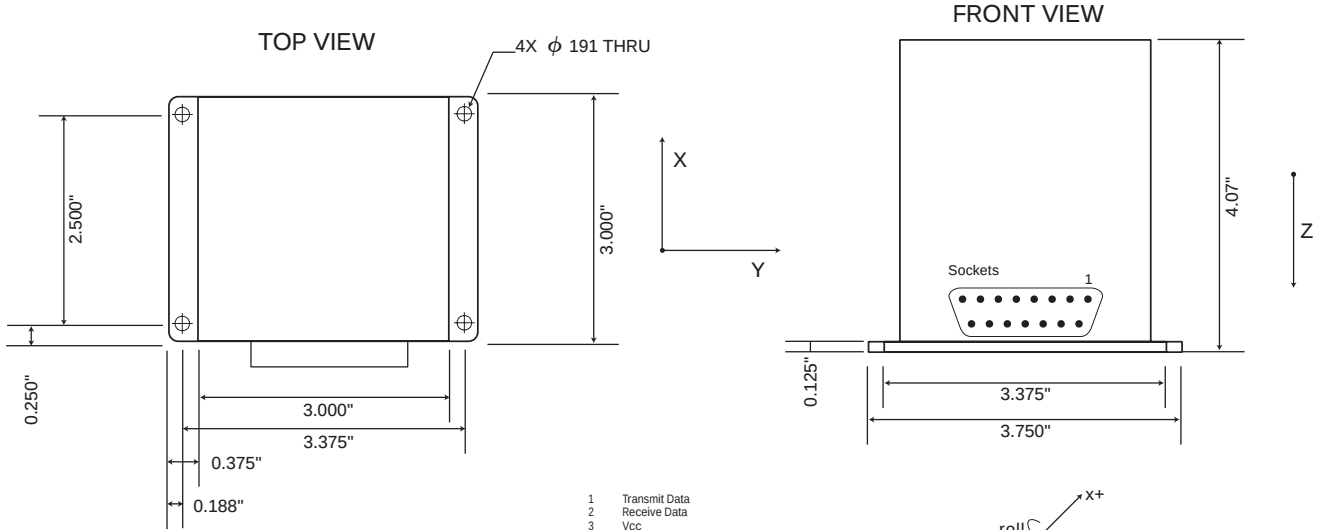
| | | |
|---|---|---|
| **Performance** | | |
| Roll, Pitch and Heading Angle: | | Application |
| Dynamic Accuracy | ±1° | Dependent |
| Repeatability | ±0.5° | Typical |
| Full Scale Span (analog outputs) | ± 4.096 VDC | |
| Roll, Pitch Angle Range | ±90° | |
| Heading Angle Range | ±180° | |
| Bandwidth | 10 Hz | |
| Linearity | <1% | |
| **Power** | | |
| Input Supply Voltage | 14.5 V - 30 V | |
| Input Supply Current | 275 mA | |
| **Environmental** | | |
| Operating Temperature Range | -40 to 85°C | |
| Storage Temperature Range | -55 to 85° C | |
| Package | Aluminum housing | |
| Weight | 1.25 lb. | |
| Mechanical Shock | 1000 G | (1 ms half sine wave) |
| Vibration | 10 G RMS | |
| **Digital Data Output Rate** | | |
| Voltage Mode | 166 Hz | |
| Scaled Sensor Mode | 156 Hz | |
| Angle Mode | 100 Hz | |
| **Analog Data Update Rate** | 200 Hz | Minimum |

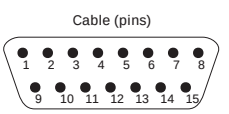
| | Angle Mode<br>16 bit 2's complement | Scaled Sensor<br>16 bit 2's complement | Voltage Mode<br>12 bit, unsigned |
|---|---|---|---|
| 0 | Header (0xFF) | Header (0xFF) | Header (0xFF) |
| 1 | Roll (MSB) | Angular Rate X (MSB) | Gyro Raw Voltage X (MSB) |
| 2 | Roll (LSB) | Angular Rate X (LSB) | Gyro Raw Voltage X (LSB) |
| 3 | Pitch (MSB) | Angular Rate Y (MSB) | Gyro Raw Voltage Y (MSB) |
| 4 | Pitch (LSB) | Angular Rate Y (LSB) | Gyro Raw Voltage Y (LSB) |
| 5 | Heading (MSB) | Angular Rate Z (MSB) | Gyro Raw Voltage Z (MSB) |
| 6 | Heading (LSB) | Angular Rate Z (LSB) | Gyro Raw Voltage Z (LSB) |
| 7 | Roll Rate (MSB) | Acceleration X (MSB) | Accelerometer Voltage X (MSB) |
| 8 | Roll Rate (LSB) | Acceleration X (LSB) | Accelerometer Voltage X (LSB) |
| 9 | Pitch Rate (MSB) | Acceleration Y (MSB) | Accelerometer Voltage Y (MSB) |
| 10 | Pitch Rate (LSB) | Acceleration Y (LSB) | Accelerometer Voltage Y (LSB) |
| 11 | Yaw Rate (MSB) | Acceleration Z (MSB) | Accelerometer Voltage Z (MSB) |
| 12 | Yaw Rate (LSB) | Acceleration Z (LSB) | Accelerometer Voltage Z (LSB) |
| 13 | Accel X (MSB) | Mag Field X (MSB) | Magnetometer Voltage X (MSB) |
| 14 | Accel X (LSB) | Mag Field X (LSB) | Magnetometer Voltage X (LSB) |
| 15 | Accel Y (MSB) | Mag Field Y (MSB) | Magnetometer Voltage Y (MSB) |
| 16 | Accel Y (LSB) | Mag Field Y (LSB) | Magnetometer Voltage Y (LSB) |
| 17 | Accel Z (MSB) | Mag Field Z (MSB) | Magnetometer Voltage Z (MSB) |
| 18 | Accel Z (LSB) | Mag Field Z (LSB) | Magnetometer Voltage Z (LSB) |
| 19 | Mag Field X (MSB) | Temp (MSB) | Temp Sensor Voltage (MSB) |
| 20 | Mag Field X (LSB) | Temp (LSB) | Temp Sensor Voltage (LSB) |
| 21 | Mag Field Y (MSB) | Time (MSB) | Time (MSB) |
| 22 | Mag Field Y (LSB) | Time (LSB) | Time (LSB) |
| 23 | Mag Field Z (MSB) | Checksum | Checksum |
| 24 | Mag Field Z (LSB) | | |
| 21 | Temp (MSB) | | |
| 22 | Temp (LSB) | | |
| 23 | Time (MSB) | | |
| 24 | Time (LSB) | | |
| 25 | Checksum | | |

Data Packet Format (v1.2)

## *Development Software*

Crossbow's X-View software is shipped with DMU products for use on PC's running MS Windows '95 & '98. X-View provides a convenient way to start system development, evaluate the performance of the DMU, and perform data acquisition. Download a free copy from our website.




| | |
|---|---|
| 1 | Transmit Data |
| 2 | Receive Data |
| 3 | Vcc |
| 4 | GND |
| 5 | X-axis Accelerometer Analog Voltage |
| 6 | Y-axis Accelerometer Analog Voltage |
| 7 | Z-axis Accelerometer Analog Voltage |
| 8 | Roll Rate Analog Voltage |
| 9 | Pitch Rate Analog Voltage |
| 10 | Yaw Rate Analog Voltage |
| 11 | Timing Pulse |
| 12 | Roll |
| 13 | Pitch |
| 14 | Heading |
| 15 | NC |